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AIR DISTRIBUTION SYSTEM FOR COMBINED REFRIGERATORS

Field of the Invention

The present invention is related to an air distribution system for combined refrigerators, with forced airflow and presenting a freezing compartment and a refrigerating compartment separated by a divisional wall.

Background of the Invention

The combined refrigerators with forced airflow are provided with ducts to conduct the cold air, which is coming from the evaporator, or evaporators, to the freezing and the refrigerating compartments.

In a known construction, as illustrated in figures 1 and 2 of the enclosed drawings, the combined refrigerators with forced airflow comprise a freezing compartment 10 and a refrigerating compartment 20, which are superposed and provided with respective front doors 11 and 21, and separated by a divisional wall 30.

Inside the refrigerating compartment 20 are provided the usual shelves 22, between which is supplied the refrigerated air coming from front openings 23a provided in a diffusing duct 23, which is generally affixed internally to the central region of a rear wall of the refrigerating compartment 20 and has an end, for example the upper end, receiving a refrigerated and forced airflow coming from an air-cooling compartment 40 lodging an evaporator 45 and a fan 46 and which is generally positioned close to the rear region of the freezing compartment 10. The return of the air that circulates in the refrigerating compartment 20 back to the cooling compartment 40 is made by capturing said circulated air in the front upper region of the refrigerating compartment 20 and conducting it to the air-cooling compartment 40

through one or more return ducts 50 provided in the interior of the divisional wall 30, or in any other adequate part of the structure of the refrigerator.

In the construction illustrated in figures 1 and 2, the combined refrigerator comprises a single evaporator 45 and a single fan 46, and a duct system that comprises a distributing duct 60 disposed in front of the air-cooling compartment 40, from which it receives the refrigerated forced airflow that is impelled by the fan 46, directing part of said forced airflow to the interior of the freezing compartment 10, through front openings 65 turned to the inside of the latter, and part of the forced airflow to the diffusing duct 23 through a connecting duct 70 generally provided through the divisional wall 30.

While being widely used in combined refrigerators, this prior art construction presents limitations which avoid improving the functional performance of these products and which are associated with their refrigerated air distribution system, leading to the creation of more elaborated and efficient solutions.

One of the most efficient solutions, which is schematically illustrated in figures 3 and 4, comprises a single evaporator, such as it occurs in the solution described above, and two fans 46, 47, one of which 46 being designed to supply a respective forced airflow to the freezing compartment 10, while the other fan 47 is positioned in the upper region of the diffusing duct 23, to supply an efficient forced airflow to the refrigerating compartment 20. In this constructive variation, the second fan 47 receives the cold air coming from a refrigeration duct 80 directly connected to the air-cooling compartment 40.

In order to comply with the refrigeration requirements of the respective compartments, to which the two fans

are operatively associated, said fans are coupled to the distributing duct 60 and to the refrigeration duct 80, which are specifically designed for this mounting arrangement.

In another prior art solution, which is an improvement of the arrangement having one evaporator and two fans, two independent refrigeration circuits are provided, one for each compartment and in which each circuit comprises one evaporator and one fan.

In this last construction (not illustrated), the forced airflow that is common to the two compartments is not provided any more and the air-cooling compartment is divided in two chambers, each of said chambers containing its fan and being associated, through respective ducts, with one of the compartments of the combined refrigerator.

The constructive solutions mentioned above present advantages and disadvantages, taking into account some aspects, such as performance, cost, and food preserving capacity. Thus, depending on the purchasing power of the consumers and the characteristics valorized in each market, the most adequate solution can vary considerably.

The different constructive solutions mentioned above for the forced air distribution in combined refrigerators are specific and differ from each other, not only in relation to the number of fans and even of evaporators, but also and mainly in relation to the construction and disposition of the ducts for the passage and direction of the forced airflow between each evaporator and the freezing and refrigerating compartments. The known constructive solutions make difficult and even unfeasible the different uses thereof, requiring considerable investments to increase the portfolio of products.

In the construction that uses one evaporator 45 and one fan 46, the distributing duct 60 is constructed to receive the whole forced airflow from the fan 46 and to divide, so as to direct a part to the freezing compartment 10 and another part to the refrigerating compartment 20, through a connecting duct 70, which is generally placed through the divisional wall 30, and through the diffusing duct 23.

In case of providing the same refrigerator with two fans 46, 47, the distributing duct 60 is specifically constructed to receive the airflow from the first fan 46, directing it only to the freezing compartment 10, it being also necessary the construction of a refrigeration duct 80 to connect the air-cooling compartment 40 directly to the connecting duct 70, to the end of which is mounted the second fan 47, which is responsible for providing a forced airflow to the refrigerating compartment 20.

In the third type of assembly foreseen herein, the air-cooling compartment 40 is divided into two chambers (not illustrated), each containing one evaporator, one chamber being connected to the refrigeration duct 80 to define a forced airflow circuit to the refrigerating compartment 20, and the other chamber is connected to the distributing duct 60, which is constructed to serve only the freezing compartment 10.

Each of said two assemblies requires one project for constructing the ducts, particularly for the distributing duct 60 that is mounted generally in front of the air-cooling compartment 40.

Objects of the Invention

Since the known constructive solutions are not versatile to suffer alterations to obtain the distribution of the forced airflow in combined

refrigerators, it is an object of the present invention to provide an air distribution system, which is capable, by making small alterations in a standardized duct element, to be easily adapted to the mounting conditions defined above, namely: one evaporator and one fan; one evaporator and two fans; and two evaporators and two fans, allowing the same duct arrangement to be applied to different needs and potentials of the final consumer.

It is a more specific object of the present invention to provide an air distribution system, such as mentioned above, which can be applied to different mounting conditions with the distributing duct presenting a standardized construction.

Summary of the Invention

The air distribution system for combined refrigerators is of the type that comprises a freezing compartment, a refrigerating compartment and an air-cooling compartment lodging at least one evaporator; a distributing duct having a rear window opened to the air-cooling compartment, at least one front opening communicating with the freezing compartment and one end opening maintained in communication with the refrigerating compartment; and at least one fan producing a forced airflow from the air-cooling compartment to the freezing compartment and to the refrigerating compartment, the distributing duct carrying a conduct, having a first end coupled to the end opening of the distributing duct, and a second end that is selectively placed in fluid communication with one of the parts defined by the distributing duct and the air-cooling compartment.

Brief Description of the Drawings

The invention will be described below, with reference to the enclosed drawings, given by way of example of a

preferred embodiment and in which:

Figure 1 is a schematic vertical cross-sectional view of a combined refrigerator with forced airflow, using the air prior art distribution system provided with one evaporator and one fan;

Figure 2 is a sectional view taken according to line II-II of figure 1, to illustrate the forced airflow outlets opened to the interior of the freezing and the refrigerating compartments;

Figures 3 and 4 are similar views to those of figures 1 and 2, respectively, but illustrating a combined refrigerator using a prior art air distribution system provided with one evaporator and two fans;

Figure 5 is a simplified schematic partial vertical view of the upper part of a combined refrigerator provided with the air distribution system of the present invention;

Figure 5a is a similar view to that of figure 5, but illustrating the air distribution system directly opened to the air distribution system with the diffusing duct;

Figure 6, 7 and 8 are perspective views of a first, a second, and a third way of using the air distribution duct of figures 5 and 5a; and

Figure 9 is a similar view to that of figure 2, but illustrating the combined refrigerator using the air distribution system of figure 8.

Description of the Illustrated Embodiment

As already mentioned, the present air distribution system is applied to a combined refrigerator with forced airflow, such as that described in relation to figures 1, 2, 3 and 4.

According to the construction proposed in the present invention, the distributing duct 60 takes the form of a parallelepipedic box, preferably made of injected

plastic material and presenting a rear basic portion 60a, in the form of a vertically disposed tray and with its rear wall 61 defining at least part of a front wall of the air-cooling compartment 40, and a front cover portion 60b to be seated and affixed against the rear basic portion 60a.

The distributing duct 60 is mounted inside the refrigerator cabinet, generally onto the divisional wall, separating the air-cooling compartment 40 from the freezing compartment 10, as illustrated in a simplified schematic manner in figure 5 of the enclosed drawings.

Regardless of the system used for the evaporation and for the forced airflow, the rear wall 61 of the rear basic portion 60a of the distributing duct 60 is provided with a window 62 axially aligned with a fan 46 that is mounted to produce a forced airflow from the interior of the air-cooling compartment 40 to the interior of the distributing duct 60 and through said window 62.

As better illustrated in figures 6, 7 and 8, the rear basic portion 60a of the distributing duct 60 contains, preferably incorporated in a single piece and in the internal side thereof, a conduct 63, the front wall portion being defined by the front cover portion 60b itself when assembled. The conduct 63 has a first end, generally the lower one, which is constantly coupled to an end opening 64, usually located in the lower region of the distributing duct 60 and to which is coupled an end of the connecting duct 70 that conducts the forced airflow to the diffusing duct 23 and from the latter to the refrigerating compartment 20.

The construction illustrated in figure 7 is of the type that uses only one evaporator 45 and one fan 46.

In this case, the whole amount of the forced airflow is produced by the fan 46 and passed through the window 62 to the inside of the distributing duct 60, wherefrom it is supplied to the freezing compartment 10 through front openings 65 provided in the front cover portion 60b.

In order to allow part of the forced airflow supplied to the distributing duct 60 to be conducted to the refrigerating compartment 20, the conduct 63 has a second end, usually the upper one, which is usually closed during the molding step of the rear basic portion 60a, and which is cut when mounted into the cabinet, to define an inlet opening 66 that communicates the conduct 63 with the interior of the distributing duct 60, allowing part of the forced airflow to be directed to the connecting duct 70 and thence to the diffusing duct 23 in the interior of the refrigerating compartment 20.

In the mounting arrangement using two fans, it is necessary to establish a fluid communication between the air-cooling compartment 40 and the diffusing duct 23. In this case, the second end of the conduct 63 is maintained closed to the interior of the distributing duct 60, but a rear opening 67 is produced, by rupturing a wall portion of the distributing duct 60, as illustrated in figure 8, to provide a fluid communication between the second end of the conduct 63 and the interior of the air-cooling compartment 40, allowing another fan 47, which is generally mounted to an end region of the diffusing duct 23, to promote a forced airflow from the air-cooling compartment 40 to the refrigerating compartment 20, passing through the conduct 63, through the connecting duct 70, and through the diffusing duct 23.

In figure 6, a third manner of using the distributing

duct 60 is illustrated, to be applied to the arrangements using two fans 46, 47 and two evaporators (not illustrated), which are mounted generally side by side, each in a respective chamber. In this case, there is no connection between the interior of the conduct 63 and of the distributing duct 60, with the forced air circuit comprising another evaporator and another fan that are exclusively associated with the refrigerating compartment 20.

It should be understood that the physical disposition of the two evaporators could be made so as to allow the rear opening 67 of the conduct 63 to be in communication with the chamber that contains the evaporator of the refrigerating compartment 20, allowing the respective forced airflow to use the conduct 63 to connect the respective evaporator chamber to the connecting duct 70 and the diffusing duct 23.

In case the above arrangement cannot be accomplished, the distributing duct 60 is maintained with the construction illustrated in figure 6, and an additional duct (not illustrated) is provided to communicate the chamber of the evaporator of the refrigerating compartment 20 with the diffusing duct 23.

As it can be noted, a single standardized construction for the distributing duct 600 allows complying with the requirements of a forced airflow distribution in a combined refrigerator having one fan and one evaporator, or one evaporator and two fans, or even two evaporators and two fans.

In order to facilitate the adaptation of the distributing duct 60 to the different mounting conditions, the parts that will be selectively removed to form the inlet opening 66, and the rear opening 67

of the conduct 63 are preferably weakened or connected to the remainder of the distributing duct 60 by weakened connecting lines.

While the invention has been illustrated and described in relation to a preferred constructive form, it should be understood that changes could be made in the form and disposition thereof, without departing from the inventive concept defined in the claims that accompany the present specification.